Kamakura Corporation

AN IN DEPTH OVERVIEW OF

KAMAKURA RISK MANAGER

VERSION 8.0

ALM

Credit Risk

Market Risk

Liquidity Risk

Transfer Pricing

Capital Allocation

Basel III

FAS 157

FAS 133

IFRS

Integrated Risk System

— JUNE 2013 —

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I. Introduction

During the credit crisis of 2007–2009, the chief executive officers of Citigroup, Merrill Lynch, Bear Stearns, Wachovia, Washington Mutual, and UBS were fired because of risk management failures at their organizations. Countrywide Financial was sold to Bank of America in a distress sale for the same reason. Without exception, these institutions relied on legacy interest rate risk, market risk, and credit risk systems that were simply unable to answer one basic question: what happens to our institution if home prices drop by 40%? Kamakura Risk Manager (KRM) is designed to answer this and many closely related questions in order to give management, the Boards of Directors, shareholders, and regulators an accurate view of the total risk of the organization, including traditional narrowly defined risk "silos." Such stress testing is now mandatory in Europe and the United States for major bank holding companies under the Supervisory Capital Assessment Program introduced in 2009 and under the Comprehensive Capital Analysis and Review 2012. Kamakura Risk Manager is the first risk system in the world to incorporate these capabilities, capturing the impact of any user-defined risk factor on defaults, prepayments, credit spreads, valuation, cash flow, and net income.

KRM is a total risk system used for:

- performance measurement,
- integrated investment portfolio and actuarial risk measurement,
- asset and liability management,
- interest rate risk,
- transfer pricing,
- liquidity risk,
- credit risk,
- Solvency II capital ratios,
- Basel II capital ratios,
- Basel III capital and liquidity ratios,
- capital allocation,
- risk-adjusted return on capital, and
- market-oriented accounting calculations like FAS 133/IAS 39 and FAS 157.

The Rationale for an Integrated Approach to Risk Management

It is now widely understood that traditional approaches to "silo" risk management are simply special cases of best practice integrated risk management: a multi-period simulation of random changes in the macro-economic environment where the default probabilities of all counterparties, from retail to corporate to sovereign, move up and down with the economy. All cash flows, financial accruals, credit spreads, defaults, and recoveries are captured through this multi-period simulation and embedded options are exercised with the user-specified degree of rationality. As the graph below shows, risk silos for the most part differ in only two dimensions: whether the simulation is multi-period (the general case) or single period (a special case), and whether or not defaults are "turned on" (the general case) or "turned off" (the special case).

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All risk analysis is a special case of multi-period credit risk analysis		
	Special Case: **Single Period** Analysis with No New Assets or Liabilities	General Case: **Multi-Period** Analysis with Cash Flow Reinvestment and New Assets and Liabilities
Special Case: **No Defaults**	Traditional VAR for Market Risk	Traditional ALM for Interest Rate Risk
General Case: **Allow Defaults** Risk-factor Driven Defaults	Credit-Adjusted VAR	Best Practice Multi-period Credit-Adjusted Simulation and Valuation for Integrated Risk Management, Capital Allocation, and Total Balance Sheet Risk Hedging

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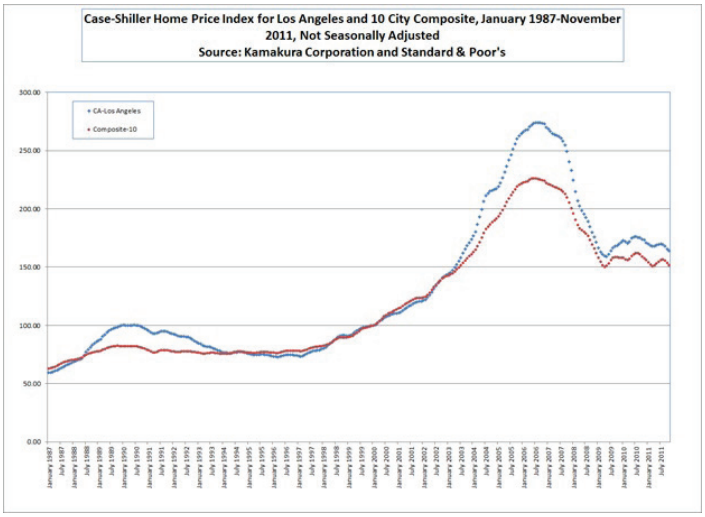
II. Macro Factors Matter in Enterprise Risk Management

After peaking in mid-2006, home prices in the United States began to drop at a rate unprecedented in modern U.S. financial history. The graph below shows the Case-Shiller home price indices for Los Angeles and the 10-City Composite Index. Home prices in Los Angeles dropped 41.9% from their peak in September 2006 to May 2009. The 10-City Composite Index peaked in June, 2006 and dropped 33.5% by April 2009. The fact that home prices were a critical risk factor for major financial institutions was not a surprise. On December 10, 2003, Kamakura Managing Director for Research Professor Robert Jarrow and four co-authors published the Loss Distribution Model mandated by the U.S. Congress for the Federal Deposit Insurance Corporation. That study explicitly identified home prices as one of three macro-factors driving correlated default of U.S. banks.



Some of the financial institutions with the largest losses from the 2007–2009 credit crisis have explicitly admitted that the losses stemmed from a lack of understanding of the exposure that the companies had to home prices. For example, Ann Reese, chairwoman of Merrill Lynch's audit committee, said the board held "numerous discussions" with management about its investments in the months before the credit crisis. "The board initially didn't realize that prices of CDOs were linked to the U.S. housing market," she said. "The CDO position did not come to the board's attention until late in the process," said Reese, a former chief financial officer of ITT Corp. and who now is co-executive director of the non-profit Center for Adoption Policy. "For reasons that we have subsequently explored, there was not a sense that these triple-A securities should be included in the overall exposure to residential real estate."[1] Another example comes from the Shareholders' Report on UBS's Write-Downs (April 18, 2008) on the reasons for UBS's massive losses in real-estate-related CDO tranches: "Whilst there were a number of credit spread RFL [risk factor limits] limits in place, there was no RFL that specifically addressed certain factors relevant to Subprime exposure, such as delinquency rates or residential real estate price developments."

Kamakura Risk Manager provides risk managers, senior management, Boards of Directors, shareholders, and regulators the capability to analyze explicitly the total risk impact of macro-economic and other pervasive risk factors such as home prices, interest rates, foreign

1 Bloomberg.com, April 24, 2008.

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exchange rates, longevity risk, other insurance risks, risk of natural and other disasters, stock prices, oil prices, commercial real estate prices, and commodity prices.

Transaction and Loan Level Detail Matter in Enterprise Risk Management
Kamakura Risk Manager is designed to operate at any level of granularity in portfolio data, but the "best practice" users of KRM use the most detailed portfolio data possible: loan and transaction level data. In the New York Times on April 27, 2008, a senior Moody's official was quoted as saying the rating agencies did not look at individual loan files in its ratings of CDOs. Kamakura's view is that a clear understanding of total risk can only be obtained by assembling the total risk of the institution, transaction by transaction. That is what KRM is designed to do.

Risk Management is more than VAR and Credit-Adjusted VAR
Bloomberg.com reported on January 28, 2008 that Merrill Lynch's value at risk was calculated at $92 million compared to actual losses from the credit crisis as of that date of $18 billion, 200 times larger than measured risk levels. Kamakura Risk Manager includes the traditional single period value at risk calculations using four standard approaches, Monte Carlo, historical simulation, variance-covariance analysis, and component value at risk. In addition, however, KRM includes important extensions to the concept to avoid the kind of risk measurement errors and "VAR myopia" that Merrill Lynch experienced. KRM includes a full multi-period value at risk calculation that allows for dynamic changes in portfolio or balance sheet composition and VAR on a fully default adjusted basis. Cash flows are re-invested, options are exercised, actuarial events (mortality, prepayment, default, prepayment, etc.) occur, and so on. Standard VAR and credit VAR make an unrealistic assumption that there is only one time period in the analysis and that the beginning balance sheet or portfolio stays unchanged. Users have this option in KRM but the best practice multi-period VAR calculation is much more realistic, because the balance sheet or portfolio evolves over time as some transactions mature and new transactions are added in a predictable fashion.

KRM for Interest Rate Risk and Asset and Liability Management
Kamakura's senior management team has more than 300 years experience as ALM and interest rate risk managers. Kamakura Risk Manager's powerful ALM capabilities include user-defined multi-factor interest rate models, multiple approaches to prepayment analysis including state of the art logistic probabilities of prepayment, dynamic movements in new business, state of the art options models consistent with the work of Professor Robert Jarrow, and modern valuation techniques for valuing complex assets and liabilities such as life insurance policies, bank owned life insurance, non-maturity deposits, servicing rights, and so on. KRM allows up to 99,999 user-defined time periods of any varying length.

- **KRM Data:** Either transaction level data (best practice) or summarized data.
- **KRM Term Structure Models:** N-factor term structure models (up to 999,999 factors) can be defined by the user.
- **KRM Fixed Income Options:** Closed form solutions, lattice solutions, and Monte Carlo solutions are available.

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- **KRM Prepayment Models:** Logistic prepayment, multinomial logit for integrated prepayment and default generation, traditional prepayment functions, prepayment tables, and a wide range of prepayment speed models.
- **KRM Options Exercise:** Fixed income options can be exercised rationally or "irrationally" subject to transaction costs to mimic actual consumer behavior.
- **KRM Non-Maturity Deposit Modeling:** Modeling can be done either using the no-arbitrage approach of Jarrow-van Deventer (1996, 1998) or by using specific user defined formulas for rate and balance evolution as a function of interest rates and the credit risk of the institution, in order to capture accurately the kind of deposit run-off experienced by firms like Washington Mutual ($26 billion out-flow), Northern Rock PLC (which lost 63% of "customer accounts"), and Wachovia.
- **KRM Default Modeling:** KRM ALM analysis can use a wide range of default models as outlined below in the KRM for credit risk section.
- **KRM Yield Curve Smoothing:** KRM provides the user with the choice of six yield curve smoothing methods and six credit spread methods for fitting current market yield curves. Among the choices are the maximum smoothness forward rate method of Adams and van Deventer (1993).
- **KRM Yield Data Format:** KRM accommodates a wide array of interest rate data formats from raw bond prices to common libor and swap market conventions.
- **KRM Roll-over and New Business Modeling:** KRM allows dynamic balance sheet evolution using a rich array of user choices regarding the investment of scheduled and unscheduled cash flows, the amount and nature of new business, and the dynamic evolution of deposit balances.
- **KRM Matched Maturity Margin Simulation:** As noted in the next section, KRM can simulate net income on both a gross basis and a matched maturity basis, recognizing the transfer pricing strategy followed by the institution.

III. KRM for Transfer Pricing and Performance Measurement

As Kamakura's van Deventer, Imai, and Mesler noted in their 2004 book Advanced Financial Risk Management, performance measurement and transfer pricing have changed enormously since Wm. Mack Terry and his team at Bank of America invented the transfer pricing concept in 1973. Kamakura Risk Manager uses the exact date of cash flow, adjusted for holidays, weekends, business day conventions and so on, to assign a cost of funds to each asset and a credit for funds for each liability. Users define which yield curve is the basis for transfer pricing, so appropriate adjustments can be made for the underlying liquidity and credit risks of the instrument being transferred. Kamakura Risk Manager boasts a wide array of yield curve and credit spread smoothing techniques and methodologies for transfer pricing assets and liabilities with embedded options.

- **KRM Transfer Pricing Techniques:** KRM allows the user to select from multiple transfer pricing techniques. The best practice technique is an exact day count matched maturity funds transfer pricing cost based on current yield curves using one of the yield curve

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smoothing techniques outlined in the KRM for Interest Rate Risk Management Section. Other techniques include transfer pricing based on constant duration or weighted average interest rate approaches.

- **KRM Transfer Pricing for Historical Data:** Transfer prices can be "recreated" on historical yield curve data and assets originated in the past by applying the technique selected by the user to data which existed at the historical point in time.
- **KRM Simulation of Transfer Pricing Margins:** KRM can simulate net income forward on both a traditional basis and on a transfer pricing basis, allowing the user to see clearly how much of the variation in net interest income is due to funding mismatches and how much is due to a matched maturity funding strategy.

IV. KRM for Market Risk

As noted above, Kamakura Risk Manager includes both traditional approaches to value at risk and credit adjusted value at risk and a much more modern approach: a dynamic multi-period credit-adjusted value at risk including component VAR. This flexibility allows market risk managers to replicate legacy systems while moving forward to a more modern approach that allows multiple VAR horizons and an analysis period as far beyond the traditional 10-day VAR calculation as the user thinks is appropriate. Many KRM users, for example, look at VAR analysis where the time horizon is many years.

- **KRM Multi-period Dynamic VAR:** KRM employs the asset and liability market practice of dynamic balance sheet modeling and fully multi-threaded Monte Carlo simulation to generate a dynamic multi-period value at risk that recognizes both portfolio evolution and the potential default of counterparties. Many Kamakura clients regard this as the best practice VAR calculation.
- **KRM Historical VAR:** KRM also calculates traditional historical value at risk based on historical movements in the yields on securities currently held by the institution. This common calculation, of course, will only be correct if the future has the same risk characteristics of the historical period used for modeling. Historical VAR can be calculated either using relative changes in asset prices (percentage changes) or absolute changes in asset prices (i.e. the dollar, yen, or Euro change in price).
- **KRM "Matrix" or Variance-Covariance VAR:** KRM also includes the selection of the traditional variance-covariance approach to VAR, which assumes that returns on assets held by the institution are normally distributed. This common calculation understates risk because of its implicit assumption that default will not occur. Using historical stock return volatility for Lehman Brothers, for example, implies that the probability of a 100% decline in the stock price (which occurred in September 2008) is 0.000000%.
- **KRM "Component" VAR:** KRM supplements traditional VAR with Component VAR. Component VAR is a variation on the standard value at risk formulation with three important properties. First, the sum of the component VARs for each transaction equals the component VAR of the portfolio as a whole, unlike the traditional VAR calculation. Second, if a transaction is deleted from the portfolio, the component VAR of the revised

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portfolio will equal the component VAR of the original portfolio minus the component VAR of the deleted transaction. It can be shown that the change in component VAR is a close approximation to the change in traditional VAR that will result. Third, the component VAR will be negative for transactions which act as a hedge for the remainder of the portfolio.

- **KRM Single Period Monte Carlo Simulation VAR:** KRM can be used for a single period Monte Carlo-driven value at risk in addition to the multi-period approach outlined above.
- **KRM Marginal VAR:** KRM Version 8.0 includes the output of the marginal contribution to VAR from taking an additional dollar of exposure to a particular asset or liability.

V. KRM for Credit Risk and Credit Portfolio Management

Kamakura Risk Manager provides credit risk managers with a steady way forward from traditional reliance on internal and external ratings to a full multi-period macro-factor driven simulation where default probabilities for all counterparties (from retail to small business to listed companies to sovereigns) rise and fall with the economy. It is the latter approach that provides true "see through" risk assessments of exposure to macro factors like home prices, avoiding the losses that Merrill Lynch, Citigroup, and UBS incurred because of the lack of transparency in macro-factor risk. Kamakura Risk Manager users can derive "delta hedges" on total portfolios and full balance sheets for each macro factor. Kamakura Risk Manager allows the use of internal ratings, internal default models, third party ratings, and default models, and the Kamakura Risk Information Services public firm, non-public firm, and sovereign default models, which can be seamlessly loaded into Kamakura Risk Manager.

- **KRM Logistic Default Models:** KRM can use user-defined or third party default models based on logistic regression or multinomial logit and user-defined variables to simulate default/no default on a multi-period basis for retail, small business, corporate, municipal and sovereign counterparties. Because this approach allows the explicit incorporation of macro-factors like home prices, oil prices, interest rates, mortality rates and so on, many KRM users regard this approach as the only methodology which would have allowed the losses of the 2007-2009 credit crisis to be avoided.
- **KRM and Logistic Regression:** KRM has the logistic regression calculation built in, so that users with particularly large modeling data bases can employ the powerful relational data base management capability in KRM for maximum modeling accuracy. Common statistical packages rely heavily on text files for inputs and have a relatively small tolerance for large data sets, so the KRM logistic regression calculation is an attractive alternative. If logistic regression models are derived outside of KRM, their coefficients are simply loaded into KRM for simulation of forward default probabilities.
- **KRM and KRIS Default Models:** KRM can seamlessly load and use the corporate, non-public firm, and sovereign default probabilities that Kamakura provides as part of its Kamakura Risk Information Services default probability service. The KRIS service also

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includes the correlation between default probabilities for any pair of companies of the 31,000 global companies in the 37 countries covered by the KRIS service.

- **KRM and Merton/Copula Default Models:** KRM can also use the traditional Merton approach to risky debt and the related copula approach to simulate default/no default as an alternative to the logistic regression approach. Although many analysts have cited the copula approach as a contributor to valuation errors in the 2007–2009 crisis, it remains a popular modeling benchmark among market participants.
- **KRM and Internal Ratings:** KRM allows internal ratings and the default probabilities associated with the ratings to be simulated forward. From the evolution of the ratings "transition matrix," default probabilities and credit spreads of all classes of borrowers can be simulated forward. This is also a popular choice among market participants.
- **KRM and Rating Agency Ratings:** KRM also allows third party rating agency ratings and transition matrices to be used to simulate default and credit spreads on a forward-looking basis.
- **KRM and Third Party Default Probabilities:** KRM allows the user to supply KRM with default probabilities from any source, whether they be from internal models or from third party vendors.
- **KRM and Loss Given Default Derived from Collateral Values:** KRM provides the user with many choices for modeling loss given default. The best practice technique, in the view of many KRM users, is to allow the user to specify how the factor driving the value of the collateral underlying the loan (say the home price or automobile price) evolves in response to changes in other macro factors. In a default scenario, KRM takes the collateral value for that loan at that point of time in the given scenario and then assumes the collateral is liquidated subject to transactions costs with a user-specified time lag from the event of default. This approach can be used even for unsecured debt instruments by modeling the "value of company assets" in the Merton style as effective collateral.
- **KRM and Random Loss Given Default:** Loss given default or the recovery rate can also be modeled in KRM as a random risk factor without modeling collateral explicitly.
- **KRM and Exposure at Default:** Basel II and Basel III require a detailed analysis of the potential exposure at default of many classes of credits. The exposure at default will be random if the transaction allows for prepayment (a "call" by the issuer of the debt) or additional drawdown (a "put" of the debt instrument to the lender by the borrower). KRM includes embedded rational and "irrational" exercise of these options by all classes of borrowers so that the exposure at default is calculated in a very realistic way.
- **KRM and Credit Default Swaps:** KRM includes valuation, cash flow generation, and financial accrual calculations for credit default swaps and a very wide array of other credit risky instruments.
- **KRM and Collateralized Debt Obligations:** KRM includes the capability to model both "cash flow" and "synthetic" collateralized debt obligations down to the individual collateral

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level. KRM also has links to the Intex and other CDO libraries for automated access to the waterfalls on individual CDO deals. For CDO transactions that are new or are not included in the Intex libraries, users can overlay their own waterfalls on the transaction level cash flow generated by KRM to get realistic cash flows and valuations for a particular tranche and waterfall structure.

- **KRM and Guarantees:** KRM allows the user to analyze the guarantee or "wrap" of a given credit instrument as a separate and distinct transaction, recognizing that the guarantor itself may default in a way that is correlated with the default of the underlying borrower whose credit has been guaranteed. After the failure of monoline insurer Ambac as a result of the credit crisis, this level of realism is considered mandatory by most of KRM users.

VI. KRM for Solvency II, Basel II and Basel III Capital Calculations

Many financial institutions have learned that Basel II requires more than a "risk weight multiplier" and this opinion is even stronger as the Basel III regulations emerge from national supervisors around the world. Solvency II for the insurance industry presents the same challenges. The existing Basel II Capital Accords from the Basel Committee on Banking Supervision incorporate a complex set of rules as to what risk weight should be assigned to a particular asset. Kamakura Risk Manager includes the full set of rules to make these calculations in a very efficient and accurate manner. Kamakura and its distributors have installed KRM for Basel II purposes from Warsaw to Hong Kong, with the appropriate modifications through the KRM-rp web based reports portal for unique national Basel II implementations. Solvency II and Basel III reporting also take advantage of the KRM-rp reporting system. Besides the Basel II and III calculations within Kamakura Risk Manager, Kamakura's risk experts provide advisory services to clients around the world on credit modeling, Basel II-compliant model audits and other key Basel II-related topics. Version 8.0 of KRM includes several updates to enable expeditious implementation of the Basel Standardized approach, as outlined in the Capital Requirements Directive (CRD) and the Prudential Sourcebook for banks, building societies and investment firms (BIPRU). KRM-rp's Basel II reports adhere to the Common Reporting Standards (COREP) specified for Basel II.

- **KRM for Simulating Basel II, Basel III, and Solvency II Capital Ratios and Liquidity Ratios Forward:** KRM is much more than a simple report on Basel II, Basel III, and Solvency II capital ratios (and in the case of Basel III, liquidity ratios) at the current point of time. The full power of KRM interest rate and credit simulation capabilities can be used to simulate capital ratios and liquidity ratios forward in time on a realistic basis so that management gets maximum early warning of potential regulatory capital shortfalls.
- **KRM for Standard Basel II Capital Ratios:** KRM calculates the standard Basel II capital ratios as part of the normal "mark to market" calculation in KRM.
- **KRM for the Advanced Internal Ratings Based Basel II Calculations:** KRM's powerful credit risk modeling capabilities make KRM the ideal vehicle for institutions pursuing the "Advanced IRB" approach to Basel II. From model building to exposure at default

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simulation, KRM has the richness to produce Basel II and Basel III Capital Ratios with maximum accuracy.

- **KRM and Kamakura Consulting for Basel II, Basel III, and Solvency II:** From Warsaw to Hong Kong, Kamakura has consulted with the modeling and risk management teams of some of the world's most sophisticated financial institutions on a number of Basel II, Basel III, and Solvency II techniques: default model construction, model audits and measures of model accuracy, linking internal ratings to default probabilities, linking third party ratings to default probabilities, linking credit scores to default probabilities, and insuring that the business cycle and macro-economic factors are properly linked to default probabilities in order to create realistic evolution of default probabilities at every point in the business cycle.
- **KRM and Local Basel II, Basel III, and Solvency II Rules and Reporting:** Using the web-based reports of KRM-rp, Kamakura has worked with clients all over the world to ensure that differences in individual country Basel II calculations and reporting formats are correctly produced in KRM-rp, including local language reporting and automated PDF file generation for electronic file submission.

VII. KRM for Capital Allocation

Kamakura Risk Manager's dynamic balance sheet simulation capabilities make it very clear that capital requirements have a term structure. Financial institutions' capital needs grow as the time horizon lengthens and when the business cycle turns down. Kamakura's multi-period simulations show the period-by-period picture of that capital needed to achieve a target institutional rating, default probability, and likelihood of survival. Stress testing of economic capital in Kamakura Risk Manager demonstrates clearly how macro-economic factors like interest rates, home prices, oil prices, stock market prices, foreign exchange rates, mortality risk, and commercial real estate prices affect capital requirements.

- **KRM Dynamic Multi-Period Credit-Adjusted Capital Simulation:** As noted in the asset and liability management and credit risk sections above, KRM allows users to simulate capital needs for an institution in a framework that recognizes cyclical default probabilities, cash flow reinvestment and the sensitivity of liability suppliers to the credit risk of the institution. (See the section below for more in that regard.) The result of these powerful capabilities is a realistic term structure of capital needs of unsurpassed accuracy. Many KRM users regard this approach as the most practice and realistic calculation for capital requirements.
- **KRM Single Period Credit-Adjusted VAR for Capital Allocation:** Many institutions have a capital allocation policy that is based on a single period credit adjusted value at risk calculation. KRM provides this special case in addition to the more general and more accurate multi-period approach outlined above.
- **KRM Capital Allocation at the Transaction Level:** KRM can calculate transaction-level capital requirements in two ways. The first way is via the sophisticated Monte Carlo simulation techniques above, where the nth percentile transaction value determines the

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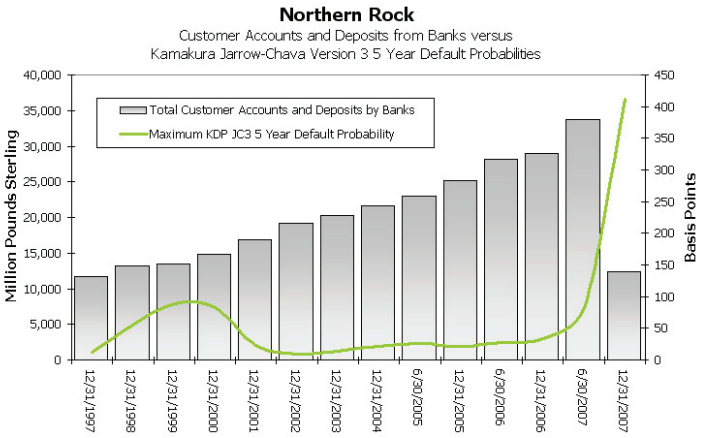
capital required in accordance with the policy of the institution doing the analysis. The second way is more general. In many institutions, the capital required often includes considerations above and beyond the Monte Carlo outputs. For institutions with this kind of capital allocation policy, KRM takes the user-supplied capital allocation formula and applies this formula to each individual transaction to get required capital. Kamakura Risk Manager can handle up to 999,999,999 Monte Carlo scenarios on a fully multi-threaded basis.

- **KRM Calculation of the Institution's Own "Inside Out" Default Probability:** As a by-product of the capital allocation calculation over N user defined periods, KRM can also produce the probability that the institution will default in each period. The institution's default probability can be defined in various ways. A common choice is to measure the percentage of scenarios in period J in which the institution has mark to market capital that is negative. An alternative definition is the percentage of scenarios in period J in which the firm has both exhausted its marginal borrowing capabilities and its cash reserves, Kamakura calls this "inside out" default probability analysis because the institution is using its "inside" knowledge of the full balance sheet to estimate the default probability, which it can then compare to the "outside" world's estimate of the default probability using only publicly available information.

VIII. KRM for Non-Maturity Deposits



On September 14, 2007, the Bank of England was forced to intervene to protect Northern Rock against the first bank run in the United Kingdom in more than a century. The chart at the left shows that Northern Rock, based in Newcastle, lost 63% of its customer accounts and deposits from banks as the bank's default probability rose approaching December 31, 2007. Many bankers overlook the fact that demand and savings deposit volumes are highly sensitive to the credit risk of the bank itself. Kamakura Risk Manager allows users to model "non-maturity" deposit volumes and their link to macro-economic factors and bank risk with maximum accuracy. The same phenomenon is captured by the Kamakura Risk Information Services Liquidity Risk data base which tracks borrowings by 1,305 financial institutions from the U.S. Federal Reserve between February 8, 2008 and March 16, 2009. The graph below shows that the liquidity risk funding shortfall for JPMorgan Chase reached $67.5 billion dollars at the point of greatest distress during the crisis:

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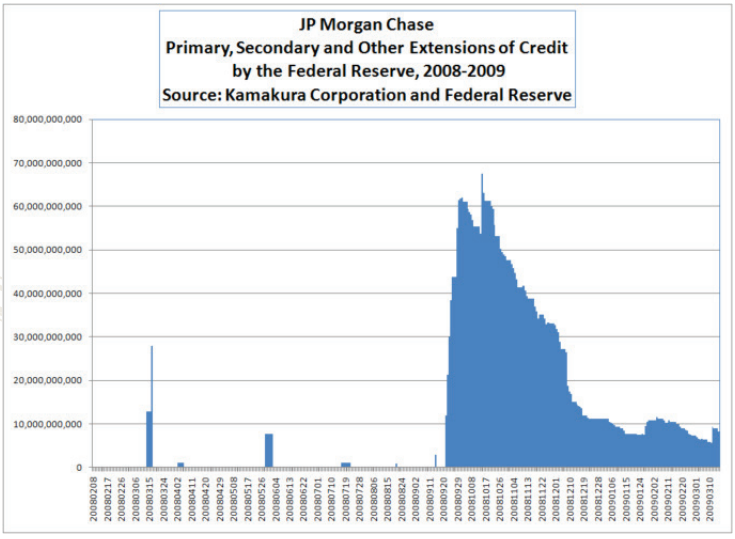

Kamakura executives Professor Robert Jarrow and Dr. Donald R. van Deventer have published extensively (1996, 1998, 1999, 2004) on how modern derivatives technology can be used to measure the profitability and risk profile of ordinary deposits.

- **KRM's Multiple Models Approach to Non-Maturity Deposits:** KRM allows the user to choose between two basic approachs to the simulation and valuation of non-maturity deposits. The first is a user-supplied formulaic approach, where the user specifies both the deposit rate function and deposit balance function. Monte Carlo simulation is then used to value the non-maturity deposits. The second approach is to use the functional form in publications by Professor Robert Jarrow and Kamakura's founder Donald R. van Deventer. If this functional form is fitted to the bank's own deposit rate and balance history, KRM can derive a valuation directly without use of Monte Carlo simulation.
- **KRM and Lessons from Northern Rock:** The examples of Northern Rock and JPMorgan Chase above show that the supply of deposits to the institution depends not only on the interest rate offered by the bank but also the bank's own riskiness. At a certain level of default risk, many depositors will not supply deposits to the bank regardless of the rate that the bank offers. This "backward bending supply curve" has been much studied in economics. In this case, the mere willingness to offer a high deposit rate on the part of the bank is a sign to depositors that the bank is near failure. KRM allows the user to link deposit volumes to macro factors like home prices, which were the relevant driver of the problems at both Northern Rock and JPMorgan Chase. This phenomenon was noted in the U.S. Federal Deposit Insurance Corporation Loss Distribution Model (Jarrow et al, December 10, 2003), where bank quality was shown to have an impact on the volume of non-maturity deposits.

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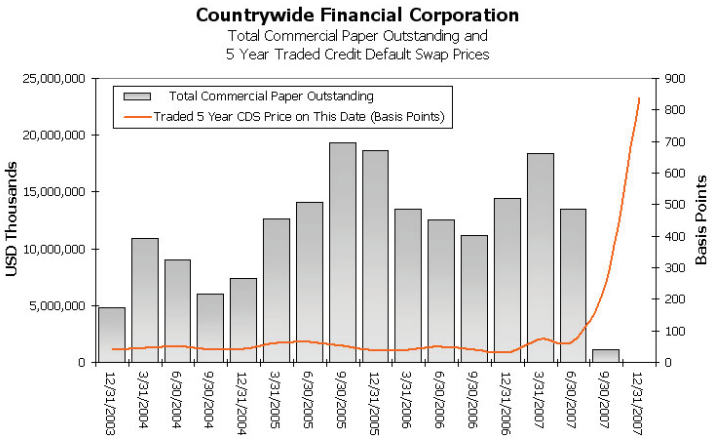
- **KRM and Modeling Early Withdrawal of Term Deposits:** Kamakura has worked extensively with two financial institutions with more than one trillion dollars in assets to model the behavior of both "non-maturity" deposits and those with an explicit maturity. In the latter case, depositors can withdraw early either because interest rates have risen on new deposits of the same type or because the credit risk of the bank has risen. KRM has many alternatives that allow users to mimic accurately the early withdrawal of term deposits for either interest rate risk or credit risk reasons. The depositors have a "put option" that allows them to cancel the transaction, often with the payment of some penalty for early withdrawal. This put option can be modeled as being either exercised with a high degree of rationality or with a user-defined "irrational" aspect.

IX. KRM for Liquidity Risk Management



In January 2008 it was announced that Bank of America would buy mortgage lender Countrywide Financial Corporation. Like the case of Northern Rock, home price declines were devastating for Countrywide's mortgage business. As investors perceived higher default risk for Countrywide, the annual premium for five-year credit default swaps on Countrywide broke out of a narrow range between 50 and 100 basis points and climbed to almost 300 basis points by September 30, 2007. The result was a 94% decline in Countrywide's ability to issue commercial paper. By December 31, 2007, credit default swap quotes exceeded 800 basis points and Countrywide was completely shut out of the commercial paper market. By June, 2008, Countrywide was forced to borrow $6.3 billion from the Federal Reserve in order to survive until the close of its merger with Bank of America. Kamakura Risk Manager allows users to measure carefully how movements in macro-economic factors like home prices and interest rates can affect liquidity risk and the institution's ability to fund itself with both retail and wholesale deposits.

- **KRM for Liquidity Risk Analysis:** By modeling the transmission of risk from the asset side of an institution (like the mortgages at Countrywide which dropped in value when home prices fell) to the liability side, KRM can very accurately measure an institution's own risk of failure. "Liquidity risk" is like the high body temperature of a patient with an illness. The high body temperature in and of itself, just as "liquidity risk," is not an independent risk. Liquidity risk is the process by which some other types of risk (credit risk, interest rate risk, operational risk, mortality risk, foreign exchange risk) devastate the value of assets, leading to the failure of the institution.

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- **KRM and the Timing of Default:** As mentioned in the non-maturity deposit section, even retail depositors fled Northern Rock as falling home prices devastated the value of the mortgages held by the bank. Within KRM, users have a rich array of modeling techniques by which to simulate the supply of liabilities and the pricing of liabilities to the institution as its risk changes. In addition, uses can look at the timing of failure in multiple ways. Two of the most common ways are to define the timing of failure as the time when (a) the mark to market value of capital becomes negative or (b) the available sources of additional borrowings and cash reserves are exhausted.
- **KRM and Liquidity Risk Management:** Liquidity risk management is the process of structuring the liability side's maturity profile in such a way as to insure survival for a specific length of time using the second definition of failure in the prior paragraph. Given the survival time policies set by management, KRM can show what liability strategy (if any) provides the ability to survive for the desired length of time in the face of deteriorating asset values. Clearly in the cases of Countrywide and Northern Rock, the survival times were very short given the sharp drop in home prices that occurred.

X. KRM for Insurance

Kamakura Risk Manager allows users to simulate a rich array of insurance events. Using modern probability techniques, users can simulate the probability of occurrence of events like default/no default, prepay/don't prepay, pay on a life insurance policy or don't pay, and so on. Using Kamakura Risk Manager, leading edge actuaries can explicitly incorporate the impact of the economy on mortality rates, as recent economic developments in Russia and Japan make so clear. Similarly, the advance of medical technology and the impact on mortality from new diseases can be simulated in a rich and realistic way, consistent with the most recent developments in medical statistics.

- **KRM and the Mathematics of Mortality Rate Modeling:** In 1971, D.R. Cox published a famous paper on the use of continuous time mortality rates for the pricing of life insurance policies. These probabilities, known as "Cox processes," are the basis for modern credit risk modeling known as the reduced form approach. Robert Jarrow, Stuart Turnbull, David Lando, and many others have employed this approach in credit risk research. Because of their common basis on the same mathematics, the links between insurance and credit risk modeling are very strong. KRM fully exploits these links.
- **KRM and Mortality Tables:** Traditional mortality tables show the mortality rate for a relatively small number of attributes of the underlying insured, such as age, male/female, smoker/non-smoker, and so on. Mortality tables have the identical structure to the user-defined prepayment tables discussed in the asset and liability management section of this report. Kamakura is actively working with insurers to allow them to incorporate proprietary mortality tables in KRM.
- **KRM and the Use of Logistic Mortality Rates:** Logistic regression has long been used in medical science to predict mortality as a function of the current health condition of the underlying subject, the exposure to various diseases, and the exposure to various

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treatment regimes. KRM has the ability to model mortality both as a function of medical and health inputs and economic conditions (as Japan and Russia have proven is relevant) in a realistic way.

- **KRM and Internal Mortality Models:** KRM can load internal mortality models directly for modeling forward, in a manner exactly parallel to the default modeling capabilities outlined in the credit risk section of this overview.
- **KRM and Customizing Mortality Models:** KRM's capabilities for modeling mortality can be most fully exploited when Kamakura experts work on a consulting basis with clients to customize mortality rate models based on the user's mortality rate data base. Best practice modeling normally uses a monthly mortality data base so that the impact of medical and macro-economic factors can be captured most clearly.
- **KRM and Property and Casualty Insurance Models:** KRM's logistic regression capability can also be used to model accident/no accident, fire/no fire, earthquake/no earthquake, tsunami/no tsunami and so on for property and insurance casualty liability valuation. Depending on the nature of the insurance contract, macro-economic variables may or may not be relevant. In weather derivatives, for example, the probability of a hurricane is independent of macro factors, but the occurrence of a hurricane can have a powerful effect on the credit risk of many counterparties (as in the New Orleans case). KRM can model this linkage.

XI. KRM for FAS 157 "Level 3" Valuations (also known as ASC 820 in the updated FASB codification)

Financial Accounting Standard 157 requires institutions to model thinly traded "hard to value" assets accurately. During the 2007-2009 credit crisis, this valuation capability became essential to many firms as the trading in mortgage-backed securities and tranches of collateralized debt obligations came to a near stand-still. Kamakura Risk Manager provides a state of the art framework that generates completely transparent valuations and an understanding of how bid-offered spreads in thinly traded markets reflect sampling error and other uncertainties in the valuation process. Kamakura consultants are actively engaged in valuation services using KRM for sophisticated financial institutions around the world.

- **KRM and FAS 157 Accuracy:** The recent credit crisis has made it clear that aggregated data and unrealistic modeling assumptions were at the heart of inaccurate valuations both at the point of origination and after origination. KRM directly addresses these problems in a concrete way, outlined in the points below.
- **KRM and Transaction Level Data:** KRM can model at the most granular level of collateral, such as the individual mortgage loans underlying a mortgage backed security that in turn is one of the instruments in a collateralized debt obligation.
- **KRM and Macro-Factor Drivers of Default:** KRM, because it can handle transaction level granularity, can show directly what impact is unleashed from the change in a macro factor like home prices. A fall in home prices first increases the probability of the default

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on the mortgage and decreases the probability of prepayment. The volatility and rise in the mortgage default probability results in a fall in value of each individual mortgage and the mortgage-backed security. The fall in the value of the mortgage backed security and the subsequent defaults impact the value of a CDO tranche. Without this "see through" valuation capability, one would make the mistakes in valuation that Merrill Lynch and UBS noted in the introduction to this document.

KRM and Full Disclosure: All Kamakura calculations are open and transparent to users and their key advisors, such as consultants and auditors. For this reason, KRM calculations are fully reconcilable, as required by best practice under **KRM for FAS 133/IAS 39 Hedge Accounting Calculations.**

Both U.S. and international accounting standards require that institutions seeking hedge accounting treatment justify a hedge by showing that market values of the assets being hedged are appropriately correlated with the hedging instrument. Kamakura Risk Manager automates the process of showing both prospective and historical hedge-related correlations.

- **KRM and Hedge Ratios:** As discussed extensively above, KRM links macro factors and the values of all instruments. Because this link applies both to the asset being hedged and the hedging instrument, KRM will accurately simulate forward the true economics that makes the hedge work.
- **KRM and Hedge Effectiveness Tests:** Looking backward, KRM incorporates the hedge effectiveness tests required by FAS 133/IAS 39 to show that there has been a historical (negative) correlation between the value of the asset being hedged and the value of the hedging position. KRM Version 8.0 generates results for three types of hedge effectiveness tests: value offset, regression, and correlation.

XII. KRM-lm for Limits Management

KRM Limits Manager is a web-based add-on to KRM that allows users to specify complex rules and limits for credit and trading risk exposure. Like all of Kamakura's web based applications, KRM-lm is designed on a multi-lingual basis and can display the logo of the KRM-lm user's institution.

- **KRM-lm and Market Valuations:** Best practice limits management supplements notional exposure limits with market valuation-based limits. KRM-lm exploits KRM's valuation capabilities for maximum accuracy in exposure management. For example, KRM-lm can correctly measure the home price risk in the super senior CDO tranches mentioned in the Merrill Lynch commentary above, given an accurate assessment of "home price" exposure in a macro factor limit, for example.
- **KRM-lm and Default Probabilities:** KRM-lm and KRM work together to incorporate daily updated default probabilities for corporate counterparties from Kamakura Risk Information Services for maximum accuracy.

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- **KRM-lm and User-Supplied Limits Formulas:** KRM-lm flexibly incorporates user-supplied limits formulations so that each installation reflects the policies and risk culture of that installation, not a "lowest common denominator" approach to risk management.

KRM-lp for Loan Pricing

The KRM Loan Pricing module is also a web-based add-on to Kamakura Risk Manager which allows KRM's sophisticated capital allocation simulations to be used to price individual loans according to the financial institution's pricing policies. It is currently used by hundreds of lending officers world-wide. Like all of Kamakura's web based applications, KRM-lp is designed on a multi-lingual basis and can display and logo of the KRM-lp user's institution.

- **KRM-lp and Risk-Adjusted Return on Capital:** KRM-lp incorporates the pricing model of the user to communicate rapidly to loan officers whether a proposed transaction meets institutional return on capital targets. If the target return is VAR based, KRM-lp reads VAR output from Kamakura Risk Manager to calculate target returns per the institution's pricing policy.
- **KRM-lp and Dynamic Loan Pricing:** As market risks change and the VAR associated with different asset classes changes, KRM-lp is updated dynamically with the latest VAR figures from Kamakura Risk Manager.
- **KRM-lp and Corporate Pricing Policy:** KRM-lp is easily updated as institutional pricing policies are updated and modified.

KRM-dm for Data Mapping

The KRM Data Mapping module is another web-based tool which is used to automate the mapping of market data and client portfolio data to standard KRM table formats. The efficiency of the KRM-dm tool is one of the many reasons why Kamakura has a flawless installation record for KRM and an excellent reputation for fast and efficient installations.

- **KRM-dm and Reuters:** KRM-dm includes a standard interface for Reuters data.
- **KRM-dm and Markit Partners:** KRM-dm includes a standard interface for Markit partners data.
- **KRM-dm and Bloomberg:** KRM-dm includes a standard interface for Bloomberg data as well.
- **KRM-dm and Proprietary Client Data:** KRM-dm is easily customized to interface with proprietary data bases maintained by the client. Kamakura's client services experts are able to do this customization easily because of their many years experience in the data base architecture of the system receiving the mapped data, Kamakura Risk Manager.

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KRM-rp for Web-based Reporting

The KRM Risk Portal KRM-rp is a rich array of standard web-based reports designed for the "read only" KRM user, those analysts who need to view and analyze the risk management information produced by KRM without the need to run the KRM system themselves. KRM-rp is used by sophisticated clients around the world. KRM-rp allows users to view proprietary data in client-defined tables in addition to reading and displaying data in the standard KRM data architecture. KRM-rp is also the vehicle for the display of risk reporting defined by national financial institution regulators around the world. KRM Version 8.0 is compatible with the newest version of KRM-rp. KRM-rp allows reporting of risk views by user-defined aggregations and hierarchies with complete "drill-down" capability to the transaction level. KRM-rp also includes a wide variety of graphing and charting options.

XIII. Other KRM Features

Kamakura Risk Manager includes the KRM-sa Security Administrator module. KRM-sa controls the rights of various uses to access selected input data bases, output data bases, and assumption sets. KRM Version 8.0 includes an extremely secure encryption of client-specific information in KRM-sa related tables and in the KRM license file.

KRM Processing Volumes

Because of the flexibility of the Kamakura Risk Manager architecture, KRM is used by clients to process portfolios that range in size from a few hundred transactions to more than 700 million, a volume record currently held by one of the largest banks in China. It is very common for KRM to be used on portfolios with millions of transactions because of the high speed processing that KRM is able to achieve.

KRM Processing Speed

KRM Version 8.0 is a fully multi-threaded application that is designed to work either on a desktop or on an array of servers for maximum speed. Because of the multi-threading capability, "worker threads" can be designated for either analysis or data base tasks in a way that takes full advantage of state of the art multi-CPU computers. KRM can easily be deployed in cluster environments if the transaction volumes require it. Kamakura consultants work closely with clients to optimize the use of multi-threading in KRM because maximum speed is a function of the client's hardware, the nature of the data being processed, and the calculations being performed by the client.

KRM Securities Coverage

Kamakura Risk Manager has an extraordinarily comprehensive ability to value and produce cash flows and financial accruals for a very wide range of transaction types. KRM has steadily grown in its ability to handle complex securities as the market place has evolved. KRM can process equities, all standard fixed income instruments, insurance liabilities, odd-amortization "one of a kind" securities, collateralized debt obligations, foreign currency derivatives, interest rate derivatives, mortgage-backed securities, and much more.

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XIV. KRM Modeling Choices

Kamakura is firmly committed to a multiple models approach to risk analysis. The user's ability to change modeling assumptions with a mouse click is essential for understanding potential model risk. It also is critical in allowing users to replicate existing "common practice" risk calculations while they evolve from "best practice" to "emerging best practice." KRM includes a full range of alternative techniques for interest rate simulation, options valuation, yield curve smoothing, default modeling, prepayment modeling, insurance event modeling, foreign exchange rate simulation, and so on.

- **Default modeling:** Merton default models, reduced form default models, ratings based default models, and transition matrices
- **Simulation of random default probabilities:** KRM supports historical sampling, correlated default probability simulation, macro-factor, and other factor driven default probability simulation and time-based drifts in default probabilities.
- **Simulation of credit spreads:** Linear credit spread functions, logistic credit spread functions (see RISK Magazine, Jarrow, Li, Mesler and Van Deventer, September 2007), and random simulation of credit spreads on a correlated basis.
- **Fixed income options valuation:** Closed form solutions, lattice solutions, and Monte Carlo solutions. Options can be exercised rationally or irrationally. Options can also be modeled as if the user is subject to transactions costs rather than assuming fully rational zero-transactions cost options exercise. Models employed include both term structure model-based options formulas and Black options formulas. All standard options types are included, such as European, American, and Bermudan options.
- **Equity and foreign exchange options valuation:** The full range of Black-Scholes variations is included in KRM.
- **Futures contract valuation:** Futures valuations are fully consistent with the term structure of interest rates and modern no arbitrage financial theory.
- **Prepayment modeling:** KRM supports prepayment functions, prepayment tables, logistic probabilistic prepayment, and third party models like Andrew Davidson & Co.
- **Yield curve smoothing:** Linear smoothing, four variations of cubic spline smoothing, and the Adams and van Deventer (1994) maximum smoothness forward rate smoothing. Data inputs for yield curve smoothing may be observable yields or raw bond prices, for both callable and non-callable bonds.
- **Credit spread smoothing:** The same six choices listed above for yield curve smoothing also apply to credit spread smoothing, where yields are calculated by smoothing relative to a user-specified risk free curve.

KRM Links to Kamakura Risk Information Services Default Probabilities

Kamakura Risk Manager links seamlessly to the Kamakura Risk Information Services default models. This link allows clients with KRM and KRIS licenses to load KRIS default probabilities, default formulas, and default correlations into KRM for analysis with the click of a mouse. No other enterprise wide risk systems vendor offers these capabilities. Kamakura

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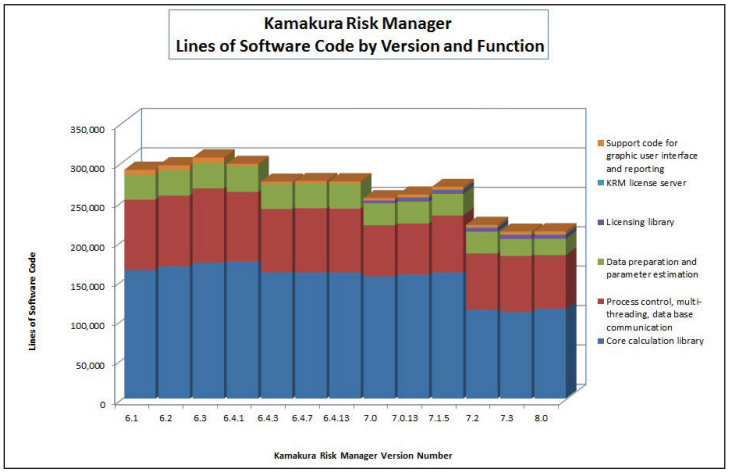
Risk Information Services was launched in 2002. KRIS now includes default probabilities on more than 31,000 public firms in 37 countries. KRIS also includes default probabilities, for non-public firms, for 183 sovereign nations, default rates for 4 classes of mortgage loans, and a number of other default models that have not yet been publicly announced. In addition to the default probabilities themselves, KRIS includes the pair wise correlation in the default probabilities for any pair of companies for accurate modeling of correlation in the events of default. See Jarrow and van Deventer (RISK Magazine, 2005) for use of this correlation in simulating random defaults.

XV. About Kamakura Risk Manager, Version 8.0

Kamakura Risk Manager, first offered commercially in 1993, has been under continuous expansion and improvement since the first lines of code were written in 1990. The KRM system is written in modern C++ class libraries that are constantly being improved from a speed and accuracy point of view. KRM version 8.0, for example, contains much more functionality but 31% fewer lines of code than KRM version 6.3 as shown in the graph below. KRM comes with a rich data base architecture that is Open Data Base Connectivity compliant with proper security. KRM runs on both Windows and UNIX, and relational data bases like MS SQL Server, Oracle, and Sybase can all be used with KRM. KRM currently supports the following data bases for use on 64-bit servers: MS SQL 2005 and 2008 and Oracle 10G R2. The KRM application server runs on Windows operating systems, but the data base servers can be run on both UNIX and Windows platforms. Kamakura Risk Manager is designed as a multiple-models risk management system, featuring a rich array of interest rate simulation techniques, default modeling approaches, prepayment simulation alternatives, and embedded options valuation methodologies. Kamakura Risk Manager is delivered with an optional set of Java-based web tools including the KRM-Risk Portal (rp) for wide dissemination of risk reports around the organization, KRM-Data Manager (dm) for easy data loading to KRM tables, KRM-Limits Manager (lm) for state of the art risk limits monitoring, and KRM-Loan Pricing (lp) for modern risk-adjusted return on capital loan pricing. KRM produces cash flows, financial accruals and valuations at all user-defined forward time periods for the full range of financial instruments, from collateralized debt obligation tranches to mortgage backed securities to simpler instruments like bonds, deposits, loans, credit default swaps, options, interest rate swaps, life insurance



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policies, non-maturity deposits, foreign exchange transactions, and so on. Recent innovations in Kamakura Risk Manager design include the following new features:

Enhancements for simulation of risk:

- KRM Version 8.0 now incorporates the ability to do time-based stress tests of any risk factor specified by the user.
- KRM Version 8.0 includes a stand-alone consolidator that facilitates the display of value at risk for any confidence level or many confidence levels.
- KRM Version 8.0 standard value at risk output has been expanded to include all of the following at the transaction level: incremental VAR, expected short-fall per transaction, component VAR, VAR decomposed by risk factor group, standard deviation of expected shortfall, standard deviation of component VAR, and standard deviation of VAR decomposed by risk factor group.
- KRM Version 8.0 includes an expanded ability to simulate counterparty credit risk across all instruments and both before and after the settlement of a given transaction.
- KRM Version 8.0 now uses profile guided optimization, which improves performance of calculation-intensive KRM configurations by 25-40%.
- KRM Version 8.0 has cut valuation time for bonds with American and Bermudan options by 50% using improved lattice technology.
- KRM Version 8.0 features advanced yield curve smoothing code, which is extensively used, that is 14% faster than prior versions.
- KRM version 8.0 uses a new memory management strategy that increases the maximum size of matrices that can be successfully handled by KRM.
- KRM version 8.0 reduces by 50% the memory requirements of certain VaR calculations when a very large number of risk factors is used.
- KRM version 8.0 features very large improvements in the efficiency of memory pool reuse, which results in better performance and a smaller memory footprint of the KRM system.
- KRM version 8.0 includes more efficient buffering of database output, which speeds up output-intensive multi-period forecast calculations by at least 25%. In some output -intensive the speed increases by a factor of 5.
- KRM version 8.0 has a significant reduction in memory copy operations and memory use in cash flow calculations, which results in much better performance.
- KRM version 8.0 Black-Scholes calculations have been made significantly faster with no loss in precision.
- KRM version 8.0 greatly reduces the number of database connection open/close requests. The new version also has a significantly reduced memory footprint for rollover and new business calculations. The result is substantially improved performance.
- KRM Version 8.0 includes an enhanced graphic user interface that is driven by a menu-driven format instead of the previous button driven format.

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Enhancements for expanded transaction coverage:

- KRM Version 8.0 now includes automated access to the Trepp libraries for the valuation and simulation of commercial mortgage backed securities (CMBS) tranches.
- KRM Version 8.0 also allows use of all 70 standard interest rate indexes used by the Trepp CMBS libraries.
- KRM Version 8.0 now includes the capability to model foreign exchange "knock-out" forward transactions.

Enhancements for greater accuracy in valuation:

- KRM Version 8.0 adds a universal formula function that can be used throughout the entire functionality of the system. This powerful new feature allows the user to select any functional form to drive N-factor term structure models and any functional form to generate default probabilities from multi-variate inputs, including interest rates.
- KRM Version 8.0 includes a significant expansion in formula capabilities including the capability to specify random variables that have an auto-regressive moving average structure (such as changes in home prices and many other macro variables).
- KRM Version 8.0 allows the use of all 6 yield curve smoothing methods and 6 credit spread smoothing methods in the full range of risk management simulations.
- KRM Version 8.0 features improved stability of option-adjusted spread calculations given exotic or extreme combinations of input parameters.
- KRM Version 8.0 allows the user to base value at risk calculations upon either (a) actual calendar days in a period, (b) actual business days in a period, or (c) a user specified number of days in a period.
- KRM Version 8.0 allows for a multi-factor shift in the option volatility surface for the KRM options analysis. Bi-linear interpolation is used to create the full volatility surface if a given input to the volatility surface is not one of the factors used to drive the shift in the volatility surface.
- KRM Version 8.0 now includes all aspects of the ISDA "big bang" changes in credit derivatives quotation bases.
- KRM Version 8.0 allows the full range of recovery rate modeling options in KRM to be used for structured products, including a lag in collection.
- KRM Version 8.0 allows the user to make prepayment speed on a pool of loans a random risk factor for both Monte Carlo simulations and stress testing.
- KRM Version 8.0 includes enhanced output of smoothed yield curves to facilitate validation of smoothed output data.
- KRM Version 8.0 now includes 19 different amortization types for fixed income securities, including the long-standing user-defined "arbitrary amortization" capability.
- KRM Version 8.0 now can utilize the arbitrary amortization for floating rate instruments as well as fixed rate instruments.
- KRM Version 8.0 further enhances the ability to model interest rate swaps where the two

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sides of the transaction have different amortization schedules.

- KRM Version 8.0 adds GARCH weightings of historical returns to KRM's historical value at risk capability.
- KRM Version 8.0 gives the user more flexibility in defining how historical returns should be sampled in historical value at risk calculations.
- KRM Version 8.0 also incorporates a valuation methodology for "simple" interest rate swaps that is 3 to 5 times faster than the prior valuation routine in KRM.
- KRM Version 8.0 now allows date-based stress tests where the shifts in the key variables occur at different points in time than the reporting periods specified by the user.
- KRM Version 8.0 enables distributed processing for date-based forecasted stress and stochastic forecasts based on historical scenarios.
- KRM Version 8.0 includes a large number of options for the user to model rollover transactions that are generated by investment of cash flow thrown off from existing assets, net of liability cash flows. Enhanced memory management is a key part of this additional functionality.
- KRM Version 8.0 includes a number of enhancements to the multi-models funds transfer pricing capability in KRM.
- KRM Version 8.0 includes a number of enhancements to Basel II calculations.
- KRM Version 8.0 also includes enhanced ease of use for multi-period simulation.

About Default Probabilities in Kamakura Risk Manager, Version 8.0

Kamakura Risk Manager allows users to specify default probabilities and related formulas for retail, small business, corporate, and sovereign counterparties using either a traditional ratings-based transition matrix approach, the legacy Merton-style approach or the state of the art reduced form modeling approach.

About Kamakura Corporation Risk Technology and Innovation

Kamakura is the leader in modern integrated risk management because of the original 1995 insights of Kamakura's Managing Director for Research, Professor Robert Jarrow. Professor Jarrow, who also serves as senior research fellow at the Federal Deposit Insurance Corporation and Professor at Cornell University, linked credit risk with a random interest rates framework in his seminal paper with Stuart Turnbull. From that point in time, Kamakura has been dedicated to a completely integrated approach to risk management software design. Professor Jarrow is assisted in research efforts by Kamakura founder Dr. Donald R. van Deventer, named to the RISK Hall of Fame with Prof. Jarrow in 2002, and Professor Jens Hilscher, named senior research fellow in 2008. More than ten Kamakura staff members have contributed to seven risk management books and over 250 published research papers and widely read blog entries on www.kamakuraco.com.

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About Kamakura Corporation

Founded in 1990, Honolulu-based Kamakura Corporation is a leading provider of risk management information, processing and software. Kamakura was named to the World Finance 100 by the Editor and readers of World Finance magazine in 2012. In 2010, Kamakura was the only vendor to win 2 Credit Magazine innovation awards, including one with distribution partner Thomson Reuters. Kamakura Risk Manager, first sold commercially in 1993 and now in version 8.0, is the first enterprise risk management system with users focused on credit risk, asset and liability management, market risk, stress testing, liquidity risk, counterparty credit risk, and capital allocation from a single software solution. The KRIS public firm default service was launched in 2002. The KRIS sovereign default service, the world's first, was launched in 2008, and the KRIS non-public firm default service was offered beginning in 2011. KRIS default probabilities are displayed for 4,000 corporates and sovereigns via the Reuters 3000 Xtra service and the Thomson Reuters Eikon service. Kamakura has served more than 220 clients ranging in size from $1.5 billion in assets to $1.6 trillion in assets. Kamakura's risk management products are currently used in more than 30 countries, including the United States, Canada, Germany, the Netherlands, France, Austria, Switzerland, the United Kingdom, Russia, the Ukraine, Eastern Europe, the Middle East, Africa, South America, Australia, Japan, China, Korea, India and many other countries in Asia.

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